

2. A Comparison of the Neotropical Species of *Corallus*, *C. cookii*, with *C. madagascariensis*; and on some Points in the Anatomy of *Corallus caninus*. By FRANK E. BEDDARD, M.A., F.R.S., Prosector to the Society.

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(Text-figures 21-27.)

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(1) A COMPARISON OF *CORALLUS COOKII* AND *C. MADAGASCARIENSIS*.

Some little time since* I contributed to the 'Proceedings' of this Society notes upon the visceral anatomy of the Madagascar Tree-Boa, *Corallus madagascariensis*. This particular species is the only one out of five or six species which inhabits Madagascar. The rest are all Neotropical in habitat. The distribution of this genus *Corallus* is therefore remarkably like that of the allied genus *Boa*, of which there are also both Neotropical and Madagascar species. This very remarkable distribution renders it particularly desirable to scrutinise carefully the structure of the species of these two genera, which inhabit two such mutually distant regions of the world. It is possible that both these instances may prove to be parallel to the case of *Solenodon* and *Centetes*, which were at one time thought to be more nearly allied than systematists are now inclined to allow, and I shall give reasons for believing that the two species of *Corallus* are different in structure. Dr. Gadov observes† that *Boa dumerili* and *Boa madagascariensis*, "both of Madagascar, cannot be separated from the genus *Boa*." Mr. Boulenger, in the British Museum Catalogue of Serpents‡, places *Corallus madagascariensis* alone in a special subdivision of the genus on account of the comparative length of its tail; but he is unable to find in external characters any features of sufficient weight to justify its generic separation from the remaining serpents placed by him and by others in the same genus. I am able in the present communication to lay some facts before the Society which bear upon this matter; and, as I have had the opportunity during the past year of dissecting no less than seven examples of an American species, *Corallus cookii*, I am able to say something about the variations shown in the anatomy of this snake; the fact that I have been able to check

* "Contributions to the Knowledge of the Vascular System, &c., in Ophidia," P. Z. S. 1906, p. 516.

† Cambridge Nat. Hist. vol. viii. Amph. & Rept. p. 602.

‡ Catalogue of Snakes, vol. i. p. 99.

my observations by the dissection of so many examples allows perhaps of a more reliable comparison of the two species, though it must be remembered that I only dissected one example of *Corallus madagascariensis*.

The seven examples of *Corallus cookii* which I have dissected were of different sizes and show among themselves a certain amount of variability in structure which will be dealt with in the following pages. For the convenience of reference, in the course of my remarks I shall refer to them as Specimen A, B, &c. Their lengths were as follows (the lengths given, it should be observed, are of the body proper, that is to the cloacal aperture. I did not trouble to measure the tail):—

A. ♀ 64 inches. B. ♂ 63 inches. C. ♂ 48½ inches. D. ♂ 71 inches. E. ♂ 65 inches. F. 64 inches. G. 53 inches.

Of the last two examples I did not ascertain the sex. I shall now deal with certain organs and systems seriatim.

§ *External Characters.*

In distinguishing the various species of *Corallus* the one from the other in his Catalogue, Mr. Boulenger makes use of a large number of characters, but does not avail himself of the number of scales which border the mental groove. This character happens to be of some use in the determination of the two species with which I deal in the present communication. I ought to say, first of all, that a faint doubt hangs over the identification of specimen A. In this individual I did not ascertain definitely that it belonged to the species *Corallus cookii* by counting the number of scales in the rows upon the body. I do not think, however, that there is really much danger of a mistake having been made in its identification; for in every other character which I examined it agreed broadly with the other individuals in which I did carefully count these scales. The numbers quite agreed with the figures given in his Catalogue by Mr. Boulenger. As to the scales which border the mental groove, I found in *Corallus madagascariensis* that the number on each side was eight. In *Corallus cookii* there are not less than nine and not more than eleven of these scales on each side, the prevailing number being ten. There is thus a difference, though doubtless a slight one, between the two species. The greater length of the mental groove in *Corallus cookii* gets perhaps some additional significance as a character of value from the fact that there is precisely the same difference, as I have already recorded*, between the two species of Anaconda, viz., *Eunectes murinus* and *E. notaus*. In the former there are seven scales on each side and in the latter only five. The same kind of difference also distinguishes two species of the genus *Boa*; for in one individual of *Boa diriniloqua* (a male) the mental groove was very short indeed and bordered only by two scales on either side,

* P. Z. S. 1906, p. 15.

while in another example (a female) by one scale only; whereas in its close ally, *Boa constrictor*, I found in one individual three scales on either side of the mental groove. I may take this opportunity of mentioning that I found in three examples of the Boid *Enygrus carinatus* five or six scales on each side of this groove. The number of scales bordering the chin-groove, although apparently useful in discriminating species, does not help in the division of the Boidæ into the two groups Pythoninæ and Boinæ; for in *Python spilotes* I found seven scales on one side and eight on the other side of the groove, and in *P. regius* four on each side. In examples of *Python sebae* and *P. molurus* there were eight of these scales on each side.

As to the *anal claws*, I have unfortunately no observations upon these in *Corallus madagascariensis*; but in *Corallus cookii* they were present and similar in both sexes, being sharp and curved. Each was ensheathed in two or occasionally three bract-like scales, which were situated on the concave side of the claw. In this latter feature *Corallus* appears to agree rather with *Eunectes* than with *Boa*; for in the latter genus the claws are ensheathed (in both sexes of *Eunectes notæus*) by two scales, while in both *Boa constrictor* and *B. divinitoqua* the female snake possesses a small sharp claw which does not appear to be ensheathed.

§ Lungs.

Although, as I shall take occasion to point out immediately, the lungs of *Corallus cookii* present certain variations in structure in the individuals of that species, they all agree to differ from those of *Corallus madagascariensis* in one important particular. The latter species on the whole resembles the genus *Boa*, in that the bronchus of the larger of the two lungs extends for a long way into its interior as a shallow gutter; in fact, to a point beyond the commencement of the liver. I may take this opportunity of recording the fact that in *Eryx conicus**, a representative of a genus undoubtedly belonging to the Boine as contrasted with the Pythonine section, the larger lung is also provided with a very long intrapulmonary bronchus. I have found the same in the Indian *Eryx johni*. In an individual of the former snake I found that the bronchus was continued down to a point corresponding with certainly the end of the first third of the liver, and that it reached the region of the lung, where it ceased to be vascular. In this snake I noticed a further peculiarity in this bronchial gutter: the "gutter" itself was of course in free communication with the interior of the lung, as the word used to describe it implies; but, in addition to this, a series of small perforations, quite numerous and regularly arranged in pairs, put the cavity of the gutter into communication with that part of the lung which was covered over by the semirings of the bronchial

* In Cuvier's 'Leçons d'Anatomie Comparée,' ed. 2, t. vii. 1840, p. 137, the same is stated of "*Erix turcicus*" (= *Eryx jaculus*).

gutter. The exact disposition of the bronchus and its relations with the lung requires further study in these animals. In all Pythons, on the other hand, which have been examined from this point of view, the lungs agree with each other to differ from those of *Boa*, *Eryx*, and *Corallus madagascariensis* in the shortness of the intrapulmonary bronchus. This varying disposition of the bronchus would appear therefore to be of generic value at least in some Boidæ; it becomes therefore a matter of some importance to note that in *Corallus cookii* the conditions observable in *Corallus madagascariensis* are not repeated, but that the intrapulmonary bronchus of the former snake is short.

Thus the two snakes, although belonging, in the opinion of many, to the same genus, show a point of difference in the structure of the lungs which in other Boidæ is at least of generic value. In *Corallus madagascariensis* there is not, as it would appear, any trace of the tracheal lung. In *Corallus cookii*, on the other hand, the extension forward of the soft tissues of the lung between the separated ends of the semirings of the trachea is, for a short distance, invaded by lung-tissue. The cellular arrangement is quite visible. It is not uncommon among snakes for the semirings of the bronchus to be continued upon the lung as a fibrous seam, which seems to mark a shrinkage of the bronchus itself; this is the case with the lung of *Corallus madagascariensis*. It must be borne in mind that this seam is not a structure differing in any essential from the internal walls of the lung. It is simply produced by a coincidence in direction of the walls of a number of lung-alveoli. That there is this coincidence, and in a longitudinal direction immediately following upon the end of the intrapulmonary bronchus, would seem to indicate the gradual obliteration of a formerly more extensive intrapulmonary bronchus. The shrinkage of this through narrowing and finally obliteration would, in my opinion, leave a straight line with pulmonary alveoli on each side, the alveoli being in consequence symmetrically arranged. This is, at any rate, a possible explanation of the phenomenon.

Another view might be held which will be explained directly. While *Corallus madagascariensis* is characterised by the possession

Explanation of Text-figs. 21 & 22 (opposite).

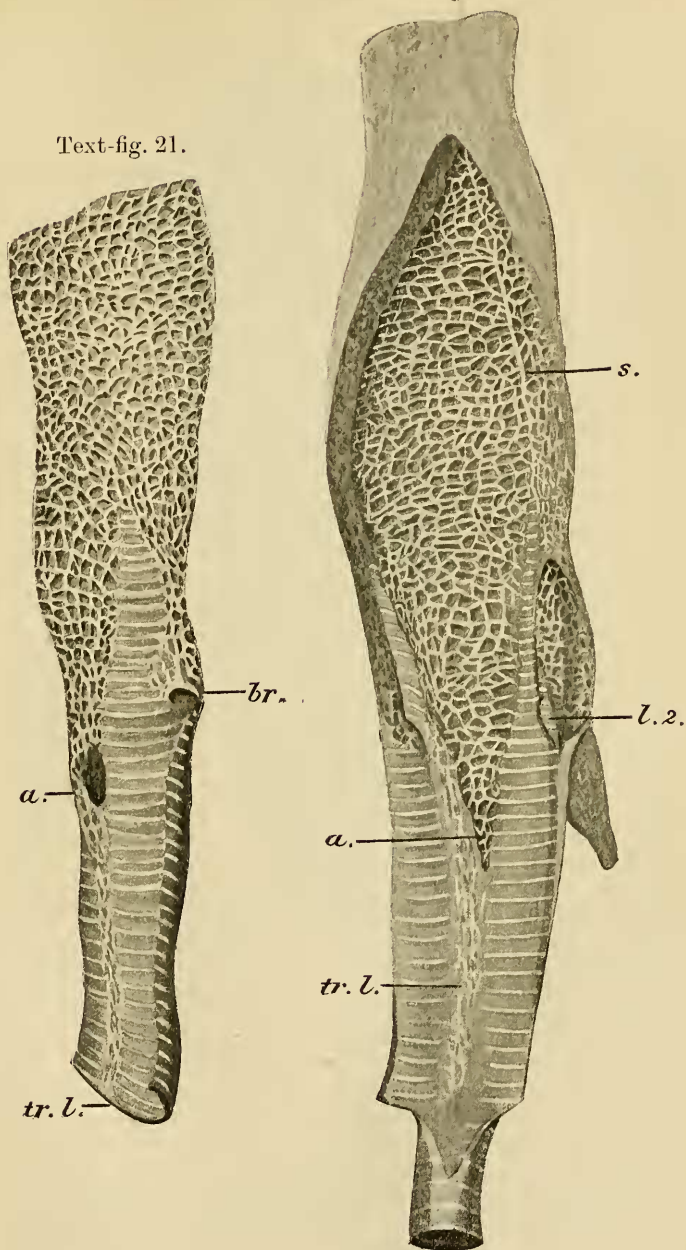
Text-fig. 21.—Larger lung of *Corallus cookii* cut open to display the entrance thereto of the trachea.

a. Forward extension of the lung lying dorsally to the trachea. *br.* Aperture of bronchus of smaller lung. *tr.l.* Tracheal lung.

Text-fig. 22.—The larger lung of another example of *Corallus cookii*, to be compared with that represented in text-fig. 21.

a. Forward caecal extension of larger lung. *1.2.* Smaller lung, below which is seen its forward caecal extension projecting to right of trachea. *s.* "Seam" running along lung. *tr.l.* Tracheal lung.

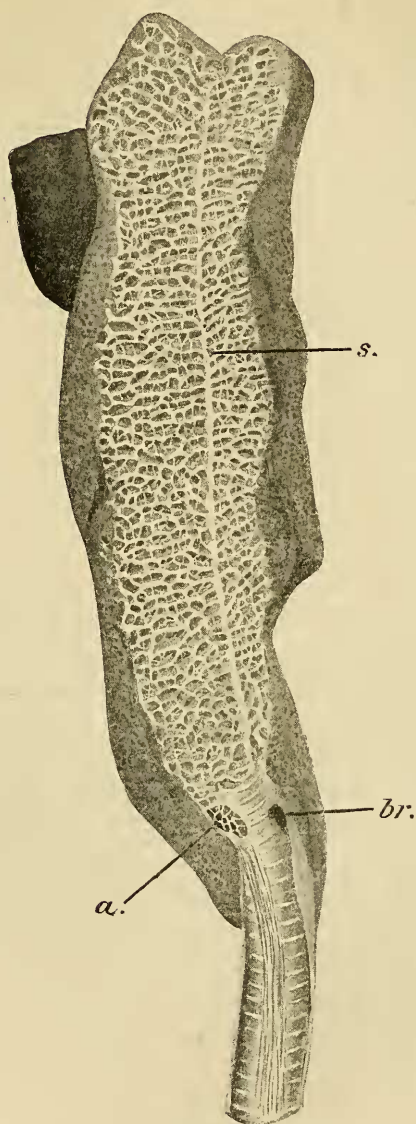
Text-fig. 22.



of this seam running down the lungs for some distance after the intrapulmonary bronchus has ceased as a series of cartilaginous bars, *Corallus cookii* has at most a small representative of this seam, which appears to be in some specimens actually absent. There is thus in any case a difference between the two species. It is necessary, however, to describe in greater detail the condition of the lungs in the specimens which I have dissected. In specimen A there was no seam at all; in B and D there was a distinct seam; in E, F, and G, I could find no seam. Of C, I have no observation upon the point. It would appear therefore that in *Corallus cookii* the seam is at least beginning to disappear, while there is no evidence that that is the case with *C. madagascariensis*, though the latter data being based upon one specimen are obviously not so secure.

The variations in the lungs of *Corallus cookii* do not, however, stop with the presence or absence of the longitudinal seam. The accompanying figures (text-figs. 21 & 22, p. 139) illustrate the anterior end of the lung in two individuals of *Corallus cookii*, and I have had drawn for comparison with them a corresponding portion of the lung of *Python spilotes*, in which snake there is a very conspicuous seam continuing the bronchus down the lung (text-fig. 23). There is, however, in *Python* no vestige of a tracheal lung and the intrapulmonary bronchus is quite short. The lungs of *Corallus cookii* figured are from the specimens D and E; one shows a seam and the other does not. Although in the lung which was removed from specimen E there was certainly not the faintest trace of a seam to be noted when the lung was examined in a fresh condition, appearances indicative of such a seam were to be seen in that lung after it had lain for some little time in a solution of formol. It occurred to me therefore, on a re-examination of the lung after it had been thus prepared, that some error must have crept into my notes. The matter is of obvious systematic importance, as will be pointed out later on in connection with the variation of another organ (the gall-bladder), and so a careful study of the lung was made. I found that the appearance of a seam in this lung was in truth only an appearance; in fact, a contraction produced by the formol had manifested itself along the line of junction of the two lungs, and here it was that the seam appeared. But on pulling apart the surfaces of the lung the "seam" was observed to disappear at once and to be therefore not a permanent structure, but merely a wrinkle produced by the contraction due to the formol. On the other hand, no amount of pulling apart would obliterate the real seam of the second lung figured, that of specimen D. Here, therefore, was a real seam, a permanent structure. It is possible, however, that these appearances, due to contraction, may be an indication of how the seam really arose in the first place. A contraction along the line of fusion of the right and left lungs might possibly become permanent in the course of generations. With regard to the seam, it is noteworthy and quite apparent in the figure that it did not begin immediately

Text-fig. 23.



Larger lung of *Python spilotes*, for comparison with text-figs. 21 & 22.

The commencement of the liver is shown to the left of the figure.

Lettering as in text-figs. 21 & 22.

with the cessation of the intrapulmonary bronchus*. It is first visible at some little distance beyond this point and extends back only for an inch or so. In comparing the larger lung in these two examples of *Corallus cookii*, another important difference will be apparent from the figures. The larger individual measured 71 inches, it will be remembered, from snout to cloacal orifice, the smaller 65 inches. The difference in length between these serpents is not therefore very large; one might fairly speak of them as being about the same size. It will, however, be noted from the accompanying figures, which are drawn to the same scale, that the lung of one of the examples is very much larger than that of the other, the difference being much more pronounced than would perhaps be expected in two snakes so nearly of the same length. It would, I should think, be imagined by anyone examining the drawings referred to, that one snake was half the size of the other. One would hardly expect to find any difference in the size of the lungs in the two individuals; and yet there is the difference described and figured. As I have contrasted the lungs not only in these two individuals but in two others, F and G, measuring respectively 64 and 53 inches, and which both possess small lungs like those of specimen E, I can venture to draw the conclusion that the lungs do certainly vary considerably in capacity within the limits of this single species. Furthermore, the tract of bronchus which lies within the lung is by no means equal in the two specimens (D and E). In the one with the smaller lung there were, so far as I could count, 16 bronchial semirings belonging to the intrapulmonary bronchus, and the length of the intrapulmonary bronchus was 17 mm. In the snake which had the larger lung there were certainly three or four more semirings, and these rings were distinctly narrower than in the other specimen, where their breadth from side to side was clearly greater. The intrapulmonary bronchus of the larger specimen measured 31 mm. In specimens F and G the intrapulmonary bronchus measured respectively 11 and 10 mm. In specimen B, the only other one of those in which I identified the presence of a seam at or near the end of the intrapulmonary bronchus, I have a note that the intrapulmonary bronchus is at least 25 mm. long. There is thus a considerable variability also in the intrapulmonary bronchus; but it will be observed that the variations in the lung tend to arrange themselves into two series. In the one the intrapulmonary bronchus is long and a seam is present; in the other the bronchus in the same region is short and there is no seam. These facts seem to point to two stages in the disappearance of the intrapulmonary bronchus.

§ Arterial System.

The arterial system, so far as I have examined it, also shows

* I find in a newly born *Eumeces notæus* a similar gap between the end of the bronchus and the beginning of the seam.

differences between the two species of *Corallus* with which I am concerned in the present communication; and the difference is rather remarkable in that it is closely paralleled among the true Pythons, as I shall point out immediately. In *Corallus cookii* the aorta gives off comparatively few intercostal branches. Yet the intervertebral spaces are served by a regularly paired series of arteries as in the Boidæ generally. The arrangement of these arteries is, in fact, like that of the Boine (as contrasted with the Pythonine) snakes, in that the few branches arising from the aorta and passing dorsally are connected together by a series of secondary longitudinal trunks; from these latter arise, at the requisite regular intervals, the actual branches which bury themselves in the intercostal spaces. This is precisely the arrangement that would have been expected in a snake belonging to the subfamily *Boinæ* of the family Boidæ according to the facts which I have been able to record in various genera of that family. It is, in fact, *Corallus madagascariensis* which is thus far "abnormal," for, as I have already recorded, in that snake the disposition of the intercostal arteries is not after the Boine but the Pythonine plan. This rather unexpected state of affairs to a certain extent of course throws doubt upon the value of these characters from a classificatory point of view. I have laid some stress in former papers upon the value of the intercostal arteries in the classification of serpents; but it is at least noteworthy that the difference in structure goes hand in hand with a totally different range in space. The Old World *Corallus madagascariensis* agrees with the Old World Pythons, while the New World *Corallus cookii* agrees with the New World Boas. The parallel instance to which I have referred above is of course *Python spilotes*; this snake, while agreeing with Pythons generally in a number of features of its organisation, has a system of intercostal arteries which is not like that of the Pythons generally, but agrees with that of the *Boinæ*. Here, again, the difference goes hand in hand with a difference in habitat; for *Python spilotes* belongs to the Australian region, while all the other Pythons that have been examined from this point of view are either African or Asiatic in range. It would be of the greatest interest to study some of the other members of the genus *Python* which occur in or near to the Australian region, and also the other American members of the genus *Corallus*. In the meantime I can only point out these rather anomalous facts. I may also mention that in those individuals where I looked for this artery each kidney had only one renal artery, as in Boidæ generally.

§ Venous System.

With reference to the venous system of *Corallus* I have observations to make only concerning the umbilical and azygos veins.

The *umbilical vein* is, so far as I know from my own observations, small and rudimentary in the Pythons, but well developed

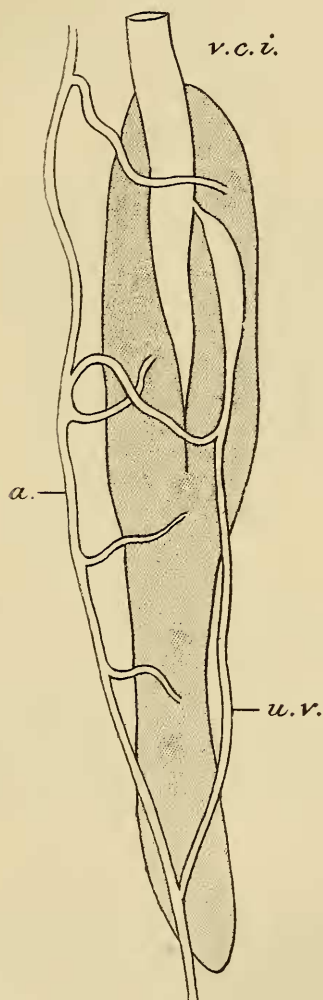
in *Boa* and *Eunectes*. I could not find this vein in *Corallus madagascariensis*. In one specimen of *Corallus cookii*, on the other hand, there is a small vein arising from the postcaval just after the commencement of the liver which I regard as probably representing that vein. It may be that I have missed it in *Corallus madagascariensis*; and yet I rather fancy that it did not occur in the specimen which I dissected, for it was naturally carefully sought for, as being of some importance in classification.

Another example happened to allow of a more accurate description of what appears to be the persistent umbilical vein, more poorly represented, or, it may be, in a poorer condition for observation in the other snake. The accompanying figure (text-fig. 24) shows this vein and its connections. Behind the liver a single epigastric vein runs along the median dorsal line in close contact with the body-wall, as in all snakes (in which it has been looked for). Passing forward, this vein divides into two, at first divergent and afterwards parallel, veins at a point about half an inch or so in front of the posterior end of the liver. The left-hand of these two veins continues to bear the characters of the epigastric vein. It emits branches to the liver, which cross over or rather under (as the animal is viewed on a dissection) the other vein. These branches enter the liver and form a part of the hepatic portal system; there are altogether five of these, the last entering the liver quite close to its anterior termination. On the other hand, the second of the two divisions of the at first single epigastric vein runs above, but gives off no branches to, the liver. This can be seen most plainly, and, as I think, is an anatomical fact—and not merely due to the vessels being invisible owing to their emptiness of blood. Close to the anterior end of the liver this vein receives a branch from the parallel epigastric vein, which runs obliquely backwards from that vein to join the parallel trunk and at this point bends downwards to reach the liver. On the surface of that organ it dilates somewhat and narrows again to be connected with the postcaval vein by at least a membranous seam in which I did not observe with certainty any blood. It may be pervious, but I am not quite determined upon the point. There are clearly reasons for looking upon this vessel as the persistent umbilical vein. If this be admitted, then it follows that in this character also the American species of the genus *Corallus* shows likenesses to the Boine rather than to the Pythonine subdivision of the Boidæ.

There is therefore in this feature also a difference between the New World and the Old World representatives of the genus *Corallus*, and, moreover, on the whole it may be said that the New World species resembles more the Boine than the Pythonine section in this particular. There is, however, by no means a close resemblance between *Corallus cookii* and the Boas in the disposition of the umbilical vein, as will be seen by a reference to my descriptions of that vein in *Boa* and *Eunectes*. That there should be differences between individuals of *Corallus cookii* is not surprising in

view of the fact that the vein is, as it would appear, a vein in course of disappearance among the Reptilia.

Text-fig. 24.



The liver and certain veins connected with it of *Corallus cookii*.

a., epigastric vein; *u.v.*, umbilical vein; *v.c.i.*, postcaval vein.

On the whole the *azygos vein* appears to be a more extensive vein among the Boidæ than among the Colubrine Snakes. I have

quoted in other papers communicated to the Society facts from my dissections relative to the shortness of this vein in both of those two great divisions of the Ophidia. With regard to the Colubrine Serpents I have now two other examples to mention which bear out the view expressed above. In *Helicops angulatus* the azygos is smaller than in any snake in which I have seen it. A stoutish vein on the right side connects the parietes with the precaval, and nothing further is seen of it after the point at which it emerges from the parietes; it is not at all continued down the body. In *Heterodon nasicus* the azygos is also small, but not smaller than in some other Colubrids in which I have described it. The vein, which is, as usual, on the right side of the body, is formed by the confluence in regular order of four intercostal branches. The last of these emerges from a circular orifice in the parietes with well-marked edges of very much greater diameter than the vein which it permits to pass out. In the case of the other branches no such orifice was visible; they simply push their way between the various layers of tissue. In the Boidæ on the whole the azygos is better developed than in the non-Boine snakes, but in no Boid which I have had the opportunity of studying is that vein so continuous for so many segments as in *Corallus cookii*. I only observed this in one specimen which happened to be particularly favourable for this examination. Furthermore, the arrangement was the same on both sides of the body, and the appearance presented by these veins was therefore reminiscent of the postcardinals in the Tailed Amphibians as figured by Hochstetter*, and as I have myself† observed. I believe that there are no embryological data as to the significance of these veins in the Boidæ, and I therefore use the term "azygos" as being in the present state of knowledge a somewhat vague term‡ with nevertheless a definite meaning of a kind§, but one which implies no homologies with other vertebrates. As I have no facts about the same veins in *Corallus madagascariensis*, and as our knowledge of this vein in the Ophidia generally is not extensive, I can make no comparisons of value except, indeed, to point out that *Corallus* is, on the whole, like other Boidæ in this respect.

§ Liver.

Corallus madagascariensis showed a curious peculiarity in the structure of the liver. The posterior end of one of the lobes of that organ was enormously prolonged as a thin tail of hepatic substance. This state of affairs is merely an exaggeration of the commonly found projection of the one of the two liver-lobes posteriorly beyond the other. In *Corallus cookii* there is some

* Morph. Jahrb., Bd. xiii. 1888, p. 119.

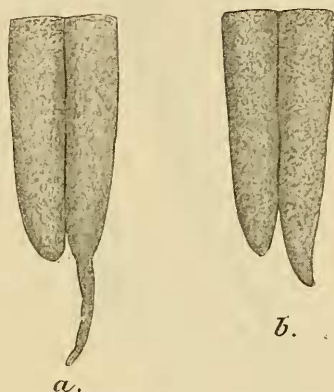
† In *Amblystoma tenebrosum*.

‡ There is not always a strict homology, as I believe, even between veins in different mammals which have been described under this name.

§ I. e., a vein which draws blood from the dorsal thoracic parietes.

variability in the form of the posterior termination of the liver (text-fig. 25), but in no specimen that I have dissected was there anything at all approaching the long thin appendage of *Corallus madagascariensis*. In one specimen, where this prolongation was particularly well developed, it only measured $\frac{3}{4}$ of an inch in length, which is far below that of the hepatic process of its presumed congener. The prolongation, in fact, in *Corallus cookii* is hardly an exaggeration of what is found in those other serpents in which the one lobe does extend further backwards than the other.

Text-fig. 25.

Posterior end of liver of two individuals (*a* & *b*) of *Corallus cookii*.

a shows a long tail-like process.

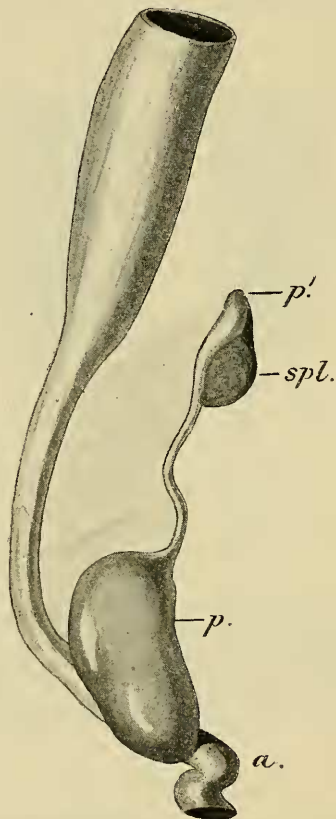
Out of the six other examples of *Corallus cookii* which I examined three had a more or less well-developed tail to the liver and three had the barest traces of the same. The two species thus contrast, it being of course assumed that the one example of *Corallus madagascariensis* which I examined represented the normal in structure.

§ *Pancreas and Spleen.*

I take these two organs together, because in the Reptilia (especially in the Ophidia) there is generally a pretty close connection between them. In *Corallus madagascariensis* the spleen is a small rounded body situated at some distance from the pancreas, which is a solid compact gland abutting on to the duodenal walls. In *Corallus cookii* the pancreas is of a different form, always assuming that I have made no error in the description of *C. madagascariensis*. In any case it is certain that in *C. cookii* (for I have identified the various structures to be

described in five individuals) the pancreas (text-fig. 26) consists of a large solid piece abutting upon the duodenal walls, as in the other species of the genus with which it is here compared; but in addition to this there is a thin isthmus of pancreatic tissue connecting the major half of the gland with a round piece of pancreatic tissue closely attached to the spleen; the latter is of course

Text-fig. 26.

Pancreas and adjacent viscera of *Corallus cookii*.

a. Commencement of coiled region of intestine. *p.* Main mass of pancreas; *p'.*, process of the same attached to spleen. *spl.* Spleen.

to be distinguished from the pancreas by its purplish colour, the pancreas being yellowish. In one example of *Corallus cookii* (specimen A) the spleen, instead of being a rounded body, is thicker at one end and tails off into a long thin process at the

other. In specimen E the spleen has traces of this peculiar form in that the rounded spleen closely attached to the nearly detached piece of the pancreas is reinforced by a splenculus situated three-quarters of an inch from it, which latter tails off into a thin process. In the other specimens the spleen is a single rounded body as I have described it in *Corallus madagascariensis*. The pancreas would appear therefore to be pretty constant in its characters in *Corallus cookii*. This form of pancreas seems to be characteristic of the family Boidæ among the Ophidia. I find in *Eryx conicus* a practically identical arrangement; so also in *Python sebae**. I have already described as characteristic of *Eunectes murinus*† that the pancreas is divided into two portions, of which one is apposed to the duodenal wall and the other is attached to the distantly situated spleen. The duct of the gland connects these two parts. It is possible that in that snake there is also an isthmus of pancreatic tissue lying along the duct; in any case there is certainly this isthmus in the other serpents to whose pancreas I have referred above. In *Python spilotes* much the same structure of these organs is to be seen; and, moreover, in that Python, as in *Eunectes murinus*, the spleen is reinforced by additional splenculi, seen also rarely in *Corallus cookii*. On the other hand, *Boa constrictor* differs in that the spleen is close to, but not much in contact with, a solid pancreas unprovided with any discrete fragment and connecting isthmus.

The organs in *Boa constrictor* are, in fact, constructed on the plan of those of the non-Boine snakes, where, however, the connection between spleen and pancreas is sometimes rather close. In *Vipera russelli* the smaller spleen sits like a cap upon the larger pancreas. In *Dasypeltis scabra* the two "glands" are in absolute contact, and in *Helicops angulatus* the spleen is actually imbedded in the wider distal end of the pancreas, appearing upon its surface in the form of two patches. Von Siebold and Stannius, in their well-known and usually (so far as my own experience goes) accurate and comprehensive text-book of comparative anatomy‡, do not sum up accurately the relations of the pancreas and the spleen when they write: "Die Milz ist getrennt vom Pancreas bei *Eryx*, *Python*, *Chersydrus*, nur wenig ihm anhängend bei *Boa*. Die Verbindung ist inniger bei den übrigen Schlangen." These observers would seem to have missed the process of the pancreas so common among the Boidæ. The fact that it is common in that group, and not, as it would appear, found elsewhere, has some significance. For among the Lacertilia there is very generally a long and thin process of the pancreas which comes into actual contact with, or at least gets

* In another example of *Python sebae* the distal portion of the pancreas was completely separated from the larger duodenal portion by an actual break in the connecting isthmus, bridged only by the pancreatic duct.

† "Contributions to the Anatomy of the Ophidia," P. Z. S. 1906, p. 25.

‡ "Handbuch der Zoologie," Bd. ii. Amphibia, 1856, p. 187. It is perhaps remarkable that Cuvier and Milne-Edwards have no observations upon these points in their text-books.

very near to, the more distantly situated spleen. As the Boidæ are believed, by reason of a considerable number of anatomical peculiarities, to stand at the base of the Ophidian series, this fact is obviously not without importance.

§ *Relative Position of Viscera.*

The relative position of the viscera among snakes and their proportionate lengths are important as diagnostic characters. Thus, in the Viperine Serpents the liver follows close upon the heart, and in the Boidæ the kidneys have rather a different position from that in the case of other Ophidia. It is not, therefore, without importance to compare the two species of *Corallus* in these particulars.

	<i>C. madagascariensis.</i>	<i>C. cookii.</i>
Total length to vent	50 inches.	64 inches.
From symphysis of jaws to auricles of heart.....	?	18½ inches.
From apex of heart to beginning of liver	2½ inches.	4¾ inches.
Length of liver.....	12½ inches.	11 inches.
Distance between end of liver and gall-bladder	½ inch.	8 inches.
Length of kidneys	1¾ inch.	3½ & 2½ inches.
Distance of end of posterior kidney from vent	About 5-6 inches.	10 inches.

It is obvious from the above measurements that there are differences between the two species, which cannot by any means be accounted for by the differences in length which they show as individuals. Thus one kidney, at any rate, of *Corallus cookii* is twice the length of that or rather those of *Corallus madagascariensis*, although the length of the snake is only one-fifth or one-sixth greater. Furthermore, the distance of the kidneys from the cloacal orifice in *C. cookii* is greater, both actually and proportionately, than in *C. madagascariensis*. This Boine character is therefore more emphasised in the American than in the Madagascar species. Although the liver of *C. madagascariensis* is slightly longer than that of the American species, this does not account for the great discrepancy which the two species show in the distance of the gall-bladder from the end of the liver. In *Corallus cookii* the two kidneys hardly overlap. The posterior kidney begins where the right kidney ends. I find that here, as in the case with *Corallus madagascariensis* and other Boidæ, the kidney of each side is furnished with only a single renal artery. This structural fact can, as I think, be now regarded as characteristic of the Boidæ as compared with many other snakes.

In view of the rather slender differences which often exist between different genera among the Ophidia, it appears to me that the differences here recorded between *Corallus madagascariensis* and *C. cookii* are worthy of receiving generic value. But for the present I do not consider the matter of a name for the Madagascar species, since there is no knowledge of the structure of the remaining American species of the genus.

The following brief statement embodies the principal anatomical characters of the two species, *Corallus madagascariensis* and *C. cookii* :—

Corallus madagascariensis.

Mental groove bordered by eight scales on each side. Bronchus continued for a considerable distance into larger lung. Intercostal arteries regularly paired like those of Python. No rudiment of umbilical vein. Liver commences closer to apex of heart, of considerable length, terminating in a very long thin posterior prolongation of one lobe. Gall-bladder close to end of liver. Pancreas with no prolongation to spleen. Kidneys short, nearer to vent.*

Corallus cookii.

Mental groove bordered by ten scales on each side. Bronchus continued only for a short distance into interior of larger lung. Intercostal arteries not regularly paired like those of Boa. A rudiment of or a more fully-developed, umbilical vein. Liver commences further from apex of heart, of less considerable length, sometimes terminating in a short thin prolongation of one lobe. Gall-bladder at a considerable distance from end of liver. Pancreas with a prolongation to spleen. Kidneys longer, further from vent.

For the measurements made above for the purpose of contrasting the two species of *Corallus*, I was compelled to select one of the larger specimens of *Corallus cookii* dissected by myself. For though I have dissected smaller examples of the same length as the individual of *Corallus madagascariensis*, the details as to the position of the viscera were unfortunately imperfect in my notes. From such details as I have preserved, however, it would not appear that much has been lost by not being able to make a more accurate comparison between the two species of snake in these particulars. Since the examples of *Corallus cookii* which I have examined range from a length of $48\frac{1}{2}$ inches to 71 inches, it becomes a matter of interest to note what, if any, alterations take place in the relative sizes of the various organs and their position with regard to each other during the process of growth. There is, furthermore, another rather important variation to be deduced from these studies, as will be apparent when the facts

* Etc. *Python spilotes* (see above, p. 143).

have been set forth. These facts are given in the accompanying table, which is regrettably imperfect in places.

	A. (64 inch.)*	B. (63)	C. (48½)	D. (71)	E. (65)	F. (64)	G. (53)
From symphysis of jaws to auricle of heart.....	18½ †	18	14	19½	?	18	17
From apex of heart to liver ...	4¾	4¼	?	5¼	?	4	?
Length of liver	11 †	11½	8	11¼	10¼	10¼	8½
From end of liver to gall-bladder	8	5½	5½	?	8	6½	6½
Length of kidneys	3½, 2½	3½, 3½	2½, 2	3½, 3	2¾, 2½	?	?
From end of posterior kidney to vent	10	9	?	12½	12	?	?

The study of the statistics presented in the above table shows, as it would appear, only one important instance of variation between individuals. That concerns the distance at which the gall-bladder is situated from the end of the liver. In specimens A, E, F, and G, particularly in the first and second of the four, the gall-bladder is markedly more distant from the end of the liver than in the remaining examples where I have noted its position. In view of its much smaller length, specimen C should perhaps be referred to the same list. It is a fact not without interest that in specimens E, F, and G the intrapulmonary bronchus is not continued by a seam down the lung, and that the lungs are relatively small. On the other hand, in the only examples in which I ascertained the presence of a seam, viz., in B and D, one, at any rate, has a large lung, and the other shows a short interval between the end of the liver and the gall-bladder. There is thus, as I venture to maintain, a commencing differentiation of species among these externally quite similar snakes. There is a distinct tendency to the segregation of the individuals into two groups: the one with a seam down the larger lung, which is relatively of larger size than in the other individuals, and a gall-bladder comparatively far removed from the posterior end of the liver; the other with relatively smaller lungs without any seam, and the gall-bladder not so far removed from the end of the liver. Apart from these series of variations, which seem to allow of the sorting into two lots of the individuals considered, other organs vary in a less regular fashion. In the liver there

* It will be recollected that the above measurements are taken from the top of the snout to the vent. They are set forth in inches.

† This and all the following measurements are in inches.

‡ The thin "tail" to one lobe of the liver is comprehended in these measurements, where it occurs. It does not occur in specimens D, E, G.

may or may not be a moderately long and thin posterior prolongation of one of the lobes; the intrapulmonary bronchus also is longer and shorter in some specimens than in others; the spleen is by no means entirely constant in its form in every individual. The position of the kidneys varies slightly, as does the amount of overlap of one by the other. The table showing the relative position of the different organs of the body indicates that there is, as might be expected, a correspondence between the lengths of the snakes and the distances separating the viscera. The table, however, does not show satisfactorily where the growth of the individual takes place, except that it would perhaps be inferred that it is not in the region following the liver; for in two individuals measuring respectively 63 and 48½ inches the distance from the end of the liver to the gall-bladder is precisely the same. I observed this carefully in the two individuals F and G. There is a difference of ten or eleven inches in total length between the snakes, and yet the distances between the end of the liver, the spleen, and the gall-bladder were exactly the same, as was conclusively shown by placing the snakes side by side, when the organs mentioned were seen to correspond exactly in position. This seems to show that the growth in length takes place both in front of and behind this particular region of the body. I should imagine that this region corresponds to the umbilical region of the new-born snake. In conclusion, it may be pointed out that the comparative fixity in the relative position of organs in so many specimens and of different lengths confirms the use of this character as of systematic value in snakes.

§ *Conclusions.*

It will be clear that the characteristics of these two species of *Corallus*, even if they be ultimately referred to two distinct genera, breaks down my previous attempts to define the subfamilies *Boinæ* and *Pythoninæ* by anatomical characters, and renders those characters only generally applicable. Hitherto these two subfamilies have been distinguished by the existence in the *Pythoninæ* of a supraorbital bone wedged in between the prefrontal, frontal, and postfrontal bones; this bone is wanting in the *Boinæ*. I presume that *Corallus* has been examined in this respect, and has been found to possess no supraorbital bone. Otherwise the *Boinæ* (and *Corallus cookii*) agree to differ from the *Pythoninæ* (including *Corallus madagascariensis*!) in the mode of distribution of the intercostal arteries, and in the persistence of a considerable umbilical vein. I am disposed to think that in view of facts accumulated since the division of the Boidæ as indicated above, it is not so desirable for the present to insist upon any such subdivision, which is, after all, by no means in accord with geographical range. On the other hand, the present communication enables me to substantiate still further the characteristics of the family Boidæ, which differs from all other

families of Ophidia, whose characters are well known, by the following distinguishing features:—

Vestiges of hind limbs present. Two lungs (except in Ungalia). Bronchi entering lungs at a little distance from their anterior extremity. Aorta giving off regularly-paired intercostal arteries or regularly-paired intercostals derived from fewer branches of aorta. Renal artery single on each side (rarely two). Umbilical vein of fœtus often persistent in adult to a greater or less extent. Anterior abdominal vein connected with afferent renals. Azygos usually long. Postcardinals present in front of kidneys. Pancreas usually with splenic lobe.

These characters are, for the most part, points of likeness to the Lacertilia, which are more numerous in the Boidæ than in other snakes. They thus argue the basal position of the Boidæ in the Ophidian series—a view which is quite generally held.

(2) SOME NOTES UPON THE ANATOMY OF *CORALLUS CANINUS*.

The comparisons instituted in the above account of the structure of *Corallus cookii* are further confirmed by the dissection of an example of *Corallus caninus*, which I have been able quite lately to examine. The specimen of this extremely beautiful species of Tree-Boa had been, as I understand, identified when alive by Mr. Boulenger. I identified it myself when dead, before learning this fact, with the help of that gentleman's 'Catalogue of the Snakes in the British Museum'*. The catalogue in question, though allowing of an easy reference of the individual to its proper species, does not refer to what appears to me to be the most salient external character of the species when compared with its immediate ally *Corallus cookii*; that is, the much greater size of the scales in the latter species. In *Corallus cookii*, in fact, a scale upon the dorsal surface near to the middle line measured 4 mm. in length; a scale from a corresponding position in *C. caninus* measured only 2 mm. The pitting of a much greater number of the labial scales than in *C. cookii* is another character of this species. I found that in the individual examined by myself the first lower labial of one side was slightly pitted. This does not appear to be always the case. The mental groove is longer in this snake than in *C. cookii*. It is bordered by fifteen scales on each side. Thus there is an exaggeration of the characters of *C. cookii*, and not an approach towards *C. madagascariensis*. On the other hand, the short tail of *C. caninus* (the length to the cloaca was 34 inches, that of the tail $5\frac{3}{4}$ inches) is an approach to the condition observable in *C. madagascariensis*. The anal claws were small, and, on account of their white colour, inconspicuous. Each lay between two scales in front and one behind, and the area of implantation was rather bare.

I have given reasons for regarding the position of the viscera

* Vol. i. London, 1893, pp. 99 & 102.

within the body of serpents generally as of systematic importance. The following are the corresponding facts relating to *Corallus caninus*:—

Length of body to cloaca, 24 inches.

From snout to heart, 9 inches.

From heart to liver, $3\frac{1}{2}$ inches.

Length of liver, $5\frac{1}{4}$ inches.

From end of liver to gall-bladder, $1\frac{1}{4}$ inches.

These measurements, though incomplete *, indicate a closer agreement with *Corallus cookii* than with the Madagascar species, as will be evident from a comparison with the tables on pp. 150 & 152. At the same time, there is perhaps some approach to the latter in the comparative closeness of the end of the liver to the gall-bladder. Moreover, the liver in *Corallus caninus* has a long thin "tail," measuring no less than an inch and a half. This, again, is a slight approach to *Corallus madagascariensis*, inasmuch as the tail of the liver in both species is about one fourth of the length of the entire liver, while in *C. cookii* there is evidently a tendency for this thin posterior prolongation of the liver to disappear. This, however, is nearly the only point in the internal anatomy of *Corallus caninus* in which I have ascertained a likeness to the Madagascar species at all more pronounced than to *Corallus cookii*. In examining the liver I naturally sought with care for vestiges of the umbilical vein. These are quite obvious, and I am even inclined to think that this vein is fairly well-developed in the present species, though its condition did not permit of an accurate mapping of the course of the vein. However, a strongish vein—the further course of which along the body-wall I am unable to state—dips down from the body-wall to the liver. Arrived upon the surface of the liver its calibre becomes increased, as is often the case with the umbilical vein in the Boine snakes; but, instead of joining the postcaval, it appears to end in the liver-substance. But its former connection (?) with the postcaval is indicated by a furrow deeply marked which connects the vein with the postcaval, continuing in the same straight line as the vein would traverse were it to pass directly to the postcaval. I think, therefore, that this vein is the persistent umbilical and not merely a branch of the epigastric. I may point out that, if this opinion is well founded, the present species of *Corallus* agrees with its American congener.

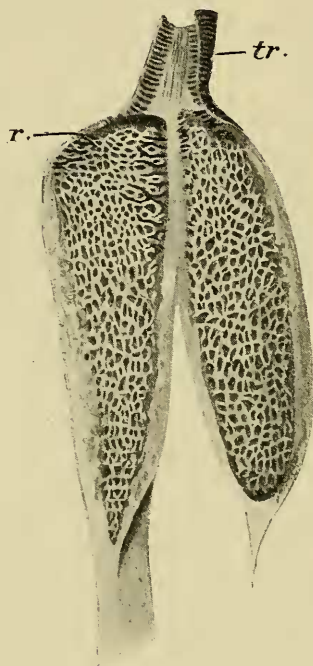
As I have already pointed out, the Madagascar and the South American species of *Corallus* differ in the relations of the pancreas to the spleen. I am bound to state that *Corallus caninus* seems to be more like *Corallus madagascariensis* than is to *Corallus cookii* in these matters. That is to say, there is no thin process of the pancreas putting the pancreas into actual contact with the anteriorly lying spleen. On the contrary, the

* It was desirable to injure the snake as little as possible.

rounded pancreas lies upon the gut, and the small spleen lies at a considerable distance from it and is without any connection with it. The spleen is rounded, distinctly divided into two lobes, but with no tail-like process. On the whole, however, it does not appear to me that these differences have generic value. For I have pointed out precisely similar differences between the two species of *Anaconda* *.

Two important anatomical features remain for consideration, in both of which *Corallus caninus* is more like its South American

Text-fig. 27.



Lungs of *Corallus caninus* cut open to show interior.

tr. Trachea. *r.* Right lung; the irregular bronchial semirings within this lung are shown on the right near to the septum between itself and the left lung.

ally. These are the arrangement of the intercostal arteries and the structure of the lungs. As to the former, *Corallus caninus* has the Boine disposition of the intercostal arteries. That is to say, there are but few of the arteries arising directly from the

* "Contributions to the Anatomy of the Ophidia," P. Z. S. 1906, p. 25. I may add that *Eryx conicus* and *E. johnei* also differ in this; for in the latter there is no "tail" to the pancreas. As to the former see above, p. 149.

aorta; but these few bifurcate and trifurcate, and from secondary longitudinal connections arise the actual intercostals. This is obviously like *Corallus cookii*.

The lungs of *Corallus caninus* are illustrated in the accompanying figure (text-fig. 27). It is obvious that they are, generally speaking, more like those of *Corallus cookii* than they are like those of the Old-World species *Corallus madagascariensis*. This is chiefly seen in the short length of the intrapulmonary bronchus. There is, however, no tracheal lung. The inter-annular membrane is readily to be distinguished from the tissues of the lung by its white colour and thick appearance. It has no lung-like structure; there is no appearance of alveoli. It is, therefore, fairly sharply marked off from the lung-tissue with which it is continuous. The bronchus of the larger lung descends into that lung for a distance of about 14 mm. This distance is, it will be observed, much the same as that found in the case of *Corallus cookii*. In the smaller lung the intrapulmonary bronchus is only 6 mm. long. In the case of the larger lung I counted 15 bronchial semi-rings. This, again, is about the number found in *Corallus cookii*. It is possible that here, as in *Corallus cookii*, there is some variability in the structure of the lung. But as I have only one example, I can merely point out that it agrees with one set of specimens of *Corallus cookii*. The intrapulmonary bronchus is rather broad; it was 8 or 9 mm. across in the case of the larger lung a little way down, and the intervening pulmonary tissue only 6 mm. across. It is important to notice that no trace of a seam could be detected. The intrapulmonary bronchus of this snake does not, as will be apparent from the figure referred to (text-fig. 27), form a regular gutter with a series of regular and similar annuli. On the contrary, the annuli are very irregular after the commencement, and are fused together and sometimes incomplete. They were to be distinguished by their very red colour in the example dissected. This irregularity is much more marked than in *Corallus cookii*. In describing above the lung of *Eryx** I have drawn attention to the series of orifices into lung-cells ranged along the sides of the bronchus and between the annuli. In the present species this condition is much more marked, and serves to distinguish the species from *Corallus cookii*. As will be seen in the figure, these orifices are numerous and scattered irregularly between various annuli. The differentiation between lung and intrapulmonary bronchus is therefore less marked in this species than in many snakes, and is by no means typically Ophidian. It recalls, in fact, very distinctly the lungs of such a reptile as *Heloderma*†.

There is a final point in the structure of the lungs of this serpent which demands attention, though it does not bear upon the main object of the present communication to the Society, viz., the relationship of the Neotropical to the Madagascar species of

* *Supra*, p. 137.

† See Beddard, P. Z. S. 1907, p. 61, text-fig. 16.

Corallus. As will be observed in the figure of the lung of *Corallus caninus*, the headward running pocket of the lungs occupies a different position in the two lungs. In the case of the larger lung it will be seen that the anterior process of the lung in question is partly roofed by the interannular membrane of the trachea as well as by the bronchial semirings. On the other hand, the same anterior process of the shorter lung has no relation whatever to the interannular tracheal membrane. I do not know how far this is to be seen in other two-lunged snakes (Boidæ). I hope to look into this matter further, since it has an obvious bearing upon the degree of degeneration of the smaller lung, and therefore upon the phylogeny of the group.

The following brief statement of the anatomical characters of the species will serve for a comparison with the corresponding definitions of *C. madagascariensis* and *C. cookii* upon p. 151.

Corallus caninus.

Mental groove bordered by 15 scales on each side. Bronchus continued only for a short distance into interior of larger lung; its rings become irregular and interrupted by orifices into lung-tissue. Intercostal arteries like those of C. cookii. A rudiment of umbilical vein persists. Liver with long posterior prolongation of hepatic substance. Gall-bladder rather near to end of liver. Pancreas with no prolongation to spleen.

The agreement with *Corallus cookii* is obviously much closer than with *C. madagascariensis*.

3. Description of a new Species of Monkey of the Genus *Cercopithecus*. By R. I. POCKOCK, F.L.S., Superintendent of the Gardens.*

[Received February 18, 1908.]

(Plate X.†)

The Zoological Society has recently acquired by purchase from Mr. F. C. Thorpe, of Hull, a young example of a species of *Cercopithecus* quite different from any form hitherto described. At Mr. Thorpe's special request I dedicate this new species to Mr. Ezra, of Calcutta.

CERCOPITHECUS EZRÆ Pocock.

Abstr. P. Z. S. 1908, p. 10 (March 3).

Skin of upper part of face black; that of the lips and chin blue, clothed with white hairs. Head ornamented in front with a

* [The complete account of the new species described in this communication appears here; but as the name and the preliminary diagnosis were published in 'Abstract,' the species is distinguished by the name being underlined.—EDITOR.]

† For description of the Plate, see p. 160.